Influence of Ecology on Linguistic Systems

Workshop

Exploring the potential of Eco-cultural Niche Modeling for reconstructing the geography of past human populations

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Overview

1. Basic facts about languages
2. The notion of ecological risk
3. Ecology, culture and languages
4. Simulation perspectives
Basic facts

Most languages have a few thousands speakers or less

Languages with high number of speakers are related to modern social institutions (states etc.)

More than 50% of human beings are multilingual

“The mere presence of interaction between people is no guarantee of their linguistic homogeneity” (Nettle, 1998)

Development of lingua francas (pidgins) or multilingualism can preserve linguistic diversity while allowing “inter-group” contacts
Linguistic continuums

Possible cultural homogeneity
For prehistory, even for a wide techno-complex, safer to think:

Many languages

Multilingualism

Language / dialect continuums

If not, good explanations must be provided…
Social networks and their linguistic consequences  
(D. Nettle, J. Milroy)

**Specialized form of exchange** (e.g. trade) / **Weak ties**
Restricted to specialized products, to some individuals, to parts of the lives of individuals

→ *Rather multilingualism or pidgins than linguistic convergence*

**Generalized form of exchange** / **Strong ties**
Involves all categories of goods & more inclusive modes of exchange (sharing, gift giving, loans…)  
Often central component of subsistence strategies, mutual dependence bounding extended families together

→ *Linguistic convergence likely to occur*
How to relate the previous elements to ecology?
Direct or indirect influences of ecology on linguistic system

- Influence of the environment (e.g. humidity) on the sounds of language?
- Whistled or drummed languages

**ECOLOGY**

**SOCIAL RELATIONSHIPS**

**LANGUAGE**

*anthropology*

*what “ecology” sometimes means in the linguistic literature*

*(socio)linguistics*
Intricate relationships between ecological & non-ecological factors
(F. Hassan, J. Nichols)

- Carrying capacity of the environment
- Efficiency of farming, yielding & hunting strategies
- Requirements for a stable organizational unit
- Preservation of genetic viability
- Patterns of exogamy
- Contacts
- Size of catchment territory
- Size of group
- Competition, conflict, prestige
- Linguistic diversity
- Geography & biotope
Global-scale modern relationship between linguistic diversity and ecology

Figure 4.1. Map of the world showing the relative language diversity of the major countries.

Note: Language diversity is calculated by regressing the logarithm of the number of languages spoken in the country against the logarithm of the area of the country, and shading each country according to the value of the standardized residual.


From (Nettle, 1998)
Ecological risk (D. Nettle)

- Primary factor: ecological risk (not physical isolation or political organization)
  - Amount of variation which people face in their food supply over time. Variation can occur both seasonally and inter-annually, with periodic years of shortage.

- Computation for a location: mean number of months in the year in which enough rain falls for useful plan growth to occur
  - Growing Season Formula (LeHouérou, 1989)

The weaker the ecological risk, the higher the linguistic diversity

- Underlying explanation:
  - Ecological risk determines the size of the network of generalized exchange in terms of:
    - Number of individuals
    - Surface covered by the network
  - Costly to have a bigger network, dangerous to have a too small one
Limitations on the relevance of the notion ecological risk

- Ecological risk applied initially to farming populations
  - Hunter-gatherer subsistence: depending on the environment, food cannot be preserved as long as farming products (few days or weeks in equatorial Africa)
  - But exchanges of goods do occur in modern hunter-gatherer populations

- Relevant for equatorial and tropical countries

Hunter-gatherer respond to depletion of resources by increased mobility

Less emphasis on social network?
Less exchanges?

Counterbalanced by

Smaller communities
Exogamy (for genetic variability)
More generalized exchanges?
Ecology, culture and language
(past hunter-gatherer populations)
Factors possibly influenced by ecology & influencing linguistic systems

i) Group size
   - +/- potential innovators; +/- resistance to change

ii) Seasonal or periodic aggregation
   - ↔ network of general exchange

iii) Population density

iv) Localized residence

v) Contacts between groups
   (nature, intensity, duration)
   - Other things being equal, the more intimate and persistent contacts, the more homogeneous the linguistic situation

Relation to ecology?
Hassan’s 4 types of demographic patterns (modern hunter-gatherer)

- Type I: tropical conditions
  ✓ Small, no seasonal aggregation, localized residence, exogamy, patrilocality

- Type II: temperate conditions
  ✓ Small-large, moderate seasonality, moderate population density; sometimes, under high pop. density, localized residence and territorial overlap; exogamy, patrilocality, sodalities

- Type IIIA: inland arctic conditions & IIIB: desert conditions
  ✓ Small, non-localized, low density, great fluctuations in group size, common periodic aggregation; exogamy, patrilocality with matrilineal alliance, bilateral or amorphous systems

- Type IV: coastal & riverine conditions
  ✓ Large group size, localized, high density, endogamy possibly supplementing exogamy, locality and lineage indeterminate
Questions of paleo-ethnicity

- Nature of the interactions between groups
  - patterns of exogamy similar to modern ones?
    - testable with population genetics?

- nature of exchanges of goods
  - e.g. raw material
  - ↔ specialized or generalized exchange?
    - test of reciprocity of generalized exchanges in the archaeological record?
  - what is the linguistic density of inter-group exchanges?
Socio-linguistic retroaction and cultural boundary formation

Given the possibilities of multilingualism and continuums, how to explain the formation of cultural boundaries?

Cultural contrasts to express social identity (not only convergence)

- Ecological pressure
- Cultural convergence
- Linguistic convergence
- Positive feedback
- Weak ecological boundary or larger linguistic distance

Group A <- Reinforcement -> Group B

Mechanic divergence

Group A <- Group B -> Group C

Time
Expressing one’s social identity

“Anspach in the Way of Fashion (1967) argues that “the initiating spark is the need of people to be like others and yet to be distinct from others” (pp. 5-6). A theory that embraces the need to be like others and the need to be distinct from others is capable of explaining any combination of events.” (Labov, 2001:361)

A linguistic feature can express a social “position”
  - Martha's Vineyard island (Labov, 1972)
Who’s first? Language or ecology?

2 opposite conceptions

i) Linguistic difference may prevent contact and explain why human groups sometimes do not interact (but linguistic exogamy!)

ii) Linguistic systems follow strategies to cope with the environment through social relationships
Who’s first? Language or ecology?

2 different conditions? (inspired from (Dixon 1997)’s model)

i) Ecological equilibrium:
reduced mobility of groups; stable but weak exchange networks with neighboring populations
→ slow linguistic convergence and cultural boundaries (contrasts)

i) Fast ecological changes:
increased mobility, encounter with more distant groups (culture & language), but more ecological pressure
→ greater weight of linguistic barriers
or / and
→ greater linguistic convergence & less impact of the previous mechanism with positive feedback?

In all cases, time matters
Time and climate fluctuations

- Time for linguistic barriers to be crossed:
  - depends on social conditions (pressure)
  - can be fast: some (years or) decades, e.g. creoles of African slaves in American plantations (Mufwene, 2001)

- e.g. Dansgaard-Oeschger climatic fluctuations
  - duration relative to speed of linguistic convergence?
  - a temporal delay in their cultural consequences due to linguistic boundaries?
Simulation perspectives

(How to better investigate former ideas?)
Simulations in linguistics

- Facing layered, highly distributed, self-organized systems

- Simulation of the emergence of language, of acquisition processes etc. …

- But very few simulations about the impact of social settings on language…
  - Costly to model in detail both linguistic and social structures

- “I have a dream”: ecology and social settings in prehistory…
Influence of social structure on language evolution
(Ke 2004; Coupé, 2004)

- Diffusion of an innovation, diversity and rate of change
- Evolution of the linguistic system: convergence / divergence according to (> 0 or < 0) social ties

Small-world network (Watts & Strogatz, 1998)
Scale-free network (Barabási & Albert, 1999)
Evolution of diversity according to the $d^\circ$ of locality of interactions

Only positive ties
From social to ecological contexts

- Ecological risk in static/dynamic settings
  - Compute ecological risk according to paleoclimate and paleovegetation and derive size of ethnolinguistic groups (nb of individuals and spatial expansion)

- Extension of current approaches on influence of social structures
  - Spatialized systems with ecological boundaries and positive feedback
  - Impact of kinship systems
  - Impact of contractions, expansions
Apply GARP algorithm to distribution of languages?

References after Guthrie (1948).

Apply GARP algorithm to structural features (J. Nichols’ database)?
Conclusions & perspectives

- Large scale versus micro-scale studies
- Time, social interactions are highly significant
- Help is needed regarding a generalized notion of ecological risk
- GARP applied to purely linguistic problems?
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Some references:

Thank you for your attention 😊